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Hospital, Maternal, and Birth Factors Associated with Hepatitis B Vaccination at Birth — West Virginia, 2015

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Abstract

Background—Hepatitis B virus (HBV) is a bloodborne pathogen typically transmitted through sexual contact, injection drug use, or perinatally. A hepatitis B vaccine (HepB) is available; the first dose is recommended at birth. We sought to identify hospital policy, maternal characteristics, and birth factors associated with HepB receipt at birth in West Virginia (WV).

Methods—We conducted a retrospective cohort study of WV live births in 2015 using vital records matched to immunization registry records to determine frequency of HepB birth dose receipt (<3 days postdelivery). We surveyed all WV birthing facilities in 2015 (N = 26) about perinatal HBV prevention policies. We examined associations of hospital policy, maternal characteristics, and birth factors with HepB receipt at birth by using a mixed-effects regression model to calculate adjusted prevalence ratios (aPRs) and 95% confidence intervals (CIs).

Results—Of 17,458 births, 14,006 (80.2%) infants received a HepB birth dose. Hospital use of preprinted newborn routine admission vaccination orders was associated with HepB birth dose receipt (aPR 10.60; 95% CI, 2.12–52.72). Not using illicit drugs during pregnancy, maternal age

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<35 years, and weekday births were associated with HepB birth dose receipt (aPR 1.81, 95% CI, 1.54–2.13; aPR 1.34, 95% CI, 1.17–1.54; and aPR 1.15, 95% CI, 1.03–1.28, respectively).

Conclusions—Hospitals using preprinted admission orders had higher frequencies of HepB birth dose receipt. Additional study is needed to identify HepB birth dose receipt barriers among infants with maternal illicit drug use, maternal age ≥35 years, or deliveries during a weekend.

Keywords

Perinatal HepB; birth dose; vaccination barriers; hospital policies

INTRODUCTION

Hepatitis B virus (HBV) is a bloodborne pathogen typically transmitted through sexual contact, injection drug use, or perinatally.[1] West Virginia (WV) has the highest acute HBV infection incidence in the United States, and reported an increase from 4.7 cases/100,000 population in 2010 to 14.7 cases/100,000 population in 2015.[2] The HBV perinatal infection incidence was 1.5 per 10,000 live births in 2015, approximating the state's acute HBV infection incidence outside the perinatal period for the same year.[3] Among infants acquiring HBV perinatally, 90% become chronically infected, increasing their lifetime risk of cirrhosis and hepatocellular carcinoma.[1] An effective hepatitis B recombinant vaccine (HepB) to prevent HBV infection is available in the United States. The Advisory Committee on Immunization Practices (ACIP) recommendations during 2015 were for infant HepB vaccination with the first dose before birthing facility discharge; infants born to mothers with positive or unknown HBV surface antigen (HBsAg) status should receive HepB ≤12 hours after birth and HBV immune globulin.[4]

Maternal characteristics have been reported as risk factors for nonreceipt of the HepB birth dose; in Colorado, higher maternal education and income were associated with HepB birth dose nonreceipt among the 2008 birth cohort.[5] However, birth characteristics (e.g., day of the week the birth occurred and type of birth attendant) have not been examined as factors associated with HepB birth dose nonreceipt. Previous studies cite lack of hospital HBV perinatal transmission prevention policies as a risk for HepB birth dose nonreceipt.[5–7] However, these studies analyzed data from populations with much lower HBV prevalence than was recently reported in WV.[2,3] Our study objectives were to determine HepB birth dose receipt rate among the 2015 WV birth cohort, identify HepB birth dose receipt rate among infants born to mothers with positive HBsAg status, and identify maternal, birth, and hospital factors associated with HepB birth dose receipt.

METHODS

Birth and Immunization Records

We conducted a retrospective cohort study of WV live births in 2015. Live births are recorded by the WV Health Statistics Center (vital records) from birth certificate worksheets submitted by birthing facilities and birth attendants. We combined vital records of all WV live births during January 1–December 31, 2015, with vaccination records from the WV Statewide Immunization Information System (WVSIIS) for infants born during the study

period. We merged data sets to obtain HepB vaccination date from WVSIIS, and maternal and birth characteristics from vital records, with birth certificate number as the common variable. Only births occurring in WV to WV resident mothers (based on vital record address) were included in the final dataset. We defined HepB receipt <3 calendar days after delivery as birth dose receipt.

Maternal and Birth Factors

Certain maternal variables from the vital records were selected on the basis of factors cited in the literature as associated with vaccine receipt or nonreciept.[5] Selected variables represent maternal characteristics, including age, race, ethnicity, education, gravidity, tobacco use during pregnancy, illicit drug use during pregnancy, marital status, receipt of Women, Infants, and Children (WIC) assistance, and primary method of payment for delivery services (health insurance). We divided race into dichotomous categories of white and nonwhite because of the limited proportion of the population in WV in 2015 identified as nonwhite (greater stratification was not possible due to small sample size within the sample strata). We categorized reported maternal age as <35 years or ≥35 years. We divided primary method of payment for delivery services into 2 groups as follows: use of Medicaid insurance versus use of any other insurance (no insurance was grouped with any other; pregnant women were eligible for Medicaid and few had no insurance). Birth event characteristics included birth facility type (hospital or nonhospital), birth attendant certification (a medical attendant—i.e., physician or nurse midwife—versus nonmedical attendant), infant sex, and day of the week of birth (weekday versus weekend). We selected maternal HBsAg status as recorded in the vital record.

Hospital Factors

During June 10–August 24, 2015, we provided a questionnaire to all 26 hospital birthing facilities from the birth record in WV addressed to the birthing facility administrators by e-mail or United States Postal Service mail. The questionnaire asked about use of three facility policies and practices regarding perinatal HBV prevention as follows: documenting maternal HBsAg test results in the infant's medical record; requiring HepB vaccination of infants before discharge; using preprinted newborn infant routine admission vaccination orders for HepB administration.[8]

Analysis

We performed analysis by using SAS® version 9.3 (SAS Institute, Cary, North Carolina). The primary outcome was HepB birth dose receipt. We calculated the frequencies of HepB birth dose receipt for all WV live births in each facility in 2015. We calculated frequency of HepB birth dose receipt by maternal HBsAg status recorded on the birth certificate. We determined frequency of HepB birth dose receipt for each maternal and birth factor, and for each perinatal HBV prevention policy. We conducted bivariate analyses to obtain crude risk ratios (CRRs), 95% confidence intervals (CIs), and *P*-values to identify individual variables associated with HepB birth dose receipt. We used a mixed-effects regression model with a logit link (PROC GLIMMIX) to calculate adjusted prevalence ratios (aPRs), where birthing facility was considered a random effect and maternal and birth characteristics and hospital policy use were considered fixed effects. Statistically significant ($P \leq .05$) variables in the

bivariate analysis were included in the mixed-effects model, after considering colinearity. Because we were interested in hospital policies, we excluded nonhospital births from the mixed-effects model.

Ethics

The study was reviewed by the Centers for Disease Control and Prevention (CDC) and designated a public health activity exempt from Institutional Review Board. Identifying information in the birth record and vaccination registry was suppressed before data was released to researchers. All data were stored on a secure server behind an approved firewall.

RESULTS

A total of 20,422 live births were reported in WV vital records during January 1–December 31, 2015. Among these, there were 19,571 (95.8%) WVSIIS records available pertaining to whether the first HepB dose was administered, including administration date. Infants born to mothers who were not WV residents at the time of delivery and infants born outside the state were excluded, resulting in 17,458 (85.5%) records in the joined dataset (vital records and WVSIIS).

Maternal and Birth Factors

The number of infants that received HepB birth dose was 14,006 (80.2%). Frequencies of HepB birth dose receipt were 26 (92.9%) of 28 infants born to mothers with positive HBsAg status and 308 (73.3%) of 420 infants born to mothers with unknown HBsAg status (Table 1). Frequencies of HepB birth dose receipt by maternal characteristics, birth factors, and hospital factors are listed in Table 2. In the bivariate analyses, hospital birth versus nonhospital birth had the strongest association with HepB birth dose receipt, followed by medical attendant versus nonmedical attendant (Table 3). However, facility type and birth attendant were highly correlated; only 21 (0.1%) of 16,541 births attended by a medical attendant occurred outside of a hospital; 779 (4.5%) of 17,299 hospital births were attended by a nonmedical attendant. Maternal age <35 years and illicit drug nonuse during pregnancy were also associated with higher likelihood of HepB birth dose receipt. Birth on a weekday was associated with higher likelihood of HepB birth dose receipt than birth on a weekend. Medicaid insurance use was associated with a lower likelihood of HepB birth dose receipt, as was maternal white race.

Hospital Factors

Completed questionnaires were received from all 26 WV hospitals that provided birthing services in 2015. Hospital frequencies of HepB birth dose administration ranged from 1.4% of live births at Facility Z to 100% of live births at Facility A (Figure). Six (23.1%) of the hospital birthing facilities had HepB birth dose receipt rates below the statewide rate of 80.2%. Only 8 (30.8%) hospital birthing facilities had a policy to document maternal HBsAg results in the infant's medical record. Seventeen (65.4%) hospital birthing facilities had a written policy to administer HepB before discharge; 22 (84.6%) used preprinted newborn infant routine admission HepB vaccination orders.

Infants born in hospitals without a policy for maternal HBsAg documentation in the infant's medical record were less likely to receive a HepB birth dose (CRR 0.86; 95% CI, 0.85–0.88), as were infants born in a hospital birthing facility without a policy to administer a HepB birth dose (CRR 0.88; 95% CI, 0.87–0.90). Infants born in hospitals using preprinted newborn infant routine admission HepB vaccination orders were significantly more likely to receive a HepB birth dose (CRR 1.48; 95% CI, 1.44–1.52) (Table 3).

Mixed-effects Model

Statistically significant variables in the bivariate analysis were included in the mixed-effects model, including illicit drug use, maternal age, day of week, health insurance, race, and all three hospital policies. Because data for the mixed-effects model only included hospital births, and only 0.1% of births attended by medical personnel occurred outside a hospital, we did not include the medical attendant variable in the model despite the fact that it was a significant bivariate predictor for HepB birth dose receipt.

Not using illicit drugs during pregnancy, adjusted for all other variables, was associated with an 81% (aPR 1.81; 95% CI, 1.54–2.13) higher likelihood of HepB birth dose receipt. Maternal age <35 years, adjusted for all other variables, was associated with a 34% (aPR 1.34; 95% CI, 1.17–1.54) higher likelihood of HepB birth dose receipt. Birth during a weekday, adjusted for all other variables, was associated with a 15% (aPR 1.15; 95% CI, 1.03–1.28) higher likelihood of HepB birth dose receipt (Table 4).

Infants born in hospitals using preprinted newborn routine admission HepB vaccination orders were 10 times (aPR 10.60; 95% CI, 2.12–52.72) more likely to receive a birth dose than infants born in hospital birthing facilities that do not use preprinted vaccination orders, after adjusting for maternal and birth characteristics and other hospital policies. The other two hospital policies were not significantly associated with HepB birth dose receipt (Table 4).

DISCUSSION

We analyzed data from >17,000 records of the 2015 birth cohort in WV, and identified policy, maternal, and birth factors associated with HepB receipt at birth that might serve as targets for intervention. Of three hospital policies examined, preprinted newborn routine admission HepB vaccination orders had the largest association with HepB birth dose receipt. Infants born to mothers who did not report illicit drug use during pregnancy, and infants born to mothers aged <35 years were more likely to receive HepB at birth than infants born to mothers who reported drug use or to mothers aged ≥35 years. Although multiple factors can influence vaccine uptake according to recommended guidelines, such as maternal perception of vaccine safety, not all factors are readily modifiable.[9–11] Further study is needed to identify modifiable barriers for born to women who use illicit drugs and for women who are aged ≥35 years to help providers and public health programs understand and overcome these barriers predelivery, and to help these mothers plan for infant HepB receipt at birth.

In a state with high HBV incidence, HepB vaccination at birth is a crucial pillar of prevention.[8,12] We achieved our first study objective, identifying the HepB birth dose coverage rate among the 2015 WV birth cohort, with a result (80.2%) that was greater than the birth dose coverage rate (68.3%) reported by the National Immunization Survey of infants born during 2012–2013.[13] Reasons for a higher birth dose coverage rate in the 2015 birth cohort might be attributable to sampling method differences or perinatal HBV prevention program successes; however, evaluation of the cause of these differences is beyond the scope of this study. Study results can be used to measure progress toward the Healthy People 2020 goal of HepB birth dose coverage at 85%.[14] ACIP updated the immunization schedule in 2017, recommending HepB receipt ≤24 hours after birth.[15] The 2017 schedule aligns with World Health Organization recommendations for HepB vaccination at birth.[16] Continued monitoring is needed to evaluate HepB birth dose receipt rates after clinicians and birthing facilities have had sufficient time to adjust to the new recommendation.

We achieved our second study objective, identifying HepB birth dose receipt frequency (92.9%) for WV infants with HBsAg positive mothers in 2015. This frequency was greater than the HepB birth dose receipt frequency for infants with HBsAg positive mothers reported by a 2006 national study.[6] However, the lower frequency (73.3%) of WV infants with unknown maternal HBsAg status who received a HepB birth dose in 2015 is concerning because infants born to mothers with HBsAg positive or unknown status have a higher risk of acquiring HBV. More study is needed for public health programs and birthing facilities to understand vaccination barriers for infants born to mothers with unknown HBsAg status and develop vaccine-related perinatal HBV transmission prevention strategies targeted to this group of at-risk infants.

We achieved the final study objective by using the bivariate statistics and the mixed-effects model. Hospital birth, compared with nonhospital birth, was associated with a 4-fold higher likelihood of HepB birth dose receipt in the bivariate analysis; however, we identified substantial variability among individual hospital frequencies of HepB birth dose administration, and a mixed-effects analysis was indicated. Our mixed-effects model confirmed that the hospital policy of using preprinted newborn infant routine admission HepB vaccination orders increased the likelihood of HepB birth dose receipt in WV hospitals, even when controlling for hospital facility, other hospital policies, maternal characteristics, and birth factors. This finding is consistent with previous studies reporting an association of hospital policies that support HepB receipt at birth with increased likelihood of receiving the vaccination.[5,6] As facilities adjust HepB birth dose procedures in accordance with the 2017 ACIP immunization schedule, maintained use or adoption of preprinted newborn routine admission HepB vaccination orders among hospital birthing facilities represents a potential opportunity for improvement in the frequency of HepB birth dose receipt.

In the mixed-effects model, infants born during a weekend were less likely to receive a HepB birth dose, a finding that indicates greater barriers to HepB birth dose receipt might be present during the weekend than during a weekday. Anecdotal information obtained from hospital nursing staff indicated that lower staffing numbers during weekends, compared with

weekdays, might contribute to lower weekend HepB birth dose receipt rates. More study of the difference between weekend and weekday staffing and procedures among hospital birthing facilities is needed to understand the weekend barrier to HepB birth dose receipt. Insufficient information was available to determine why infants born to older women had lower birth dose receipt rates, although this finding has been reported elsewhere.[5] Birth dose information campaigns targeting pregnant women aged >35 or who use illicit drugs might be considered by clinicians and public health professionals seeking to increase HepB receipt at birth. Infants born outside a hospital also had lower birth dose receipt rates; understanding and overcoming birth dose vaccination barriers for these infants is a reasonable goal for clinicians providing care for them.

A strength of this study is that the vital record and WVSIIS database provide a population-based parameter rather than an estimate. Also, all hospital birthing facility administrators responded to the survey, providing a thorough examination of the 2015 birth cohort. This is the first HepB birth dose study that focuses on an exclusively rural population; no cities in WV had a 2015 population ≥50,000. Also, this is the first study to examine factors associated with HepB birth dose receipt entirely within WV, where acute HBV infection incidence is highest in the United States. Our methods determined hospital birthing facility compliance with ACIP immunization schedule guidelines in 2015 for HepB birth dose receipt; if the HepB birth dose receipt definition is modified for the 2017 ACIP standard, then the same methods could be used to determine compliance in subsequent years.

At least five limitations apply to these results. First, results pertain only to the 2015 WV birth cohort; generalizability of the findings to birth cohorts outside WV might be limited. Second, our birth dose receipt definition (<3 days after birth) did not account for initial HepB administration ≥3 days after birth and before hospital discharge (if discharge was ≥3 days after birth). Defining a HepB birth dose presented a challenge because in 2015, ACIP defined a birth dose as infant HepB receipt before facility discharge. However, neither hospital discharge date nor HepB receipt before discharge were included in the vital record or WVSIIS. To avoid including HepB vaccinations that might have been given at an outpatient visit after hospital discharge (which are occasionally done as early as the third day of life) as HepB birth doses, we defined a HepB birth dose as the first HepB vaccination received <3 calendar days after birth. Third, hospital policy was assumed to be constant throughout 2015; any policy changes during 2015 were not reflected in these results. Fourth, education and training level of hospital staff was not evaluated. Finally, the accuracy of maternal HBsAg status recorded on the birth certificate is unknown, and might vary by facility.

CONCLUSIONS

WV HepB birth dose coverage in 2015 was within 5% of the Healthy People 2020 goal, and almost all infants born to HBsAg positive mothers received a HepB birth dose. Areas for further study include identifying vaccination barriers for infants born during the weekend, infants born to mothers who use illicit drugs during pregnancy, and infants born to mothers aged ≥35 years. The hospital policy of using preprinted newborn infant routine admission HepB vaccination orders has the strongest association with HepB birth dose receipt of any

maternal, birth, or hospital factor, and should be among the first considerations when attempting to improve HepB birth dose receipt. Public health professionals can share policies associated with higher HepB birth dose coverage with facilities identified as having the lowest HepB birth dose rates. Tools and other resources to assist facilities seeking to increase HepB birth dose receipt rates are available on the CDC website: https://www.cdc.gov/hepatitis/hbv/perinatalxmtn.htm.

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Abbreviations

ACIP	Advisory Committee on Immunization Practices
aPR	adjusted prevalence ratio
CDC	Centers for Disease Control and Prevention
CI	confidence interval
CRR	crude risk ratio
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
HepB	hepatitis B vaccine
WIC	Women, Infants, and Children
WV	West Virginia
WVSIIS	West Virginia Statewide Immunization Information System

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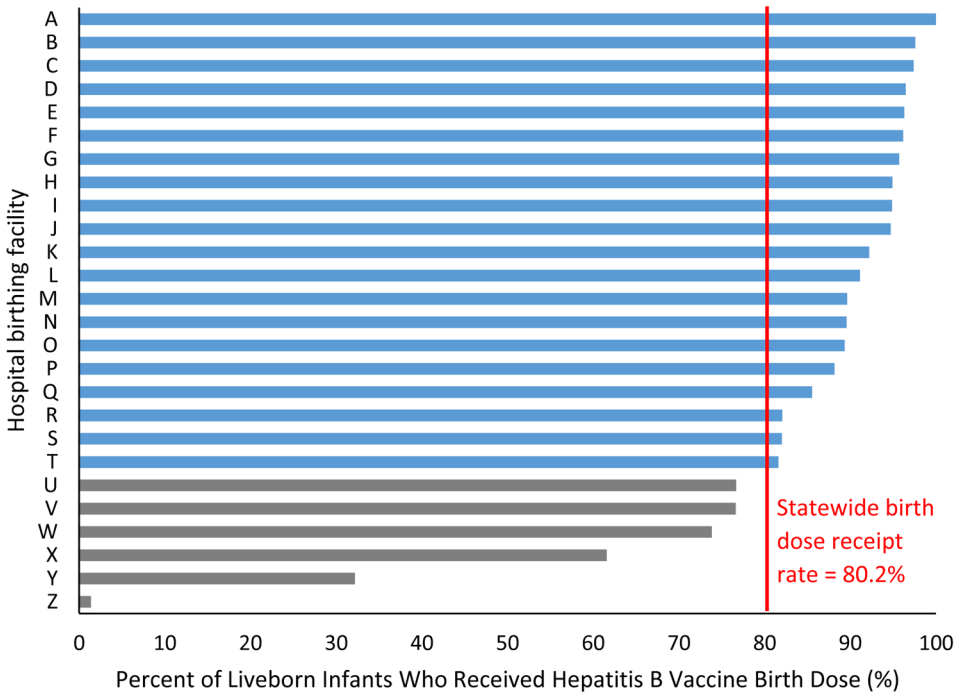

FIGURE.

Percentage of liveborn infants who received hepatitis B vaccine birth dose by hospital birthing facility in West Virginia, 2015. We observed noticeable variability of birth dose receipt rates among the 26 hospitals birthing facilities (A–Z); 6 facilities (light grey bars) fell short of the statewide rate of 80.2% (dashed line).

Percentage of Liveborn Infants Who Received Hepatitis B Vaccine Birth Dose by Hospital Birthing Facility—West Virginia, 2015 (N = 26).

TABLE 1

Hepatitis B Vaccine Birth Dose Receipt Frequency by Maternal Hepatitis B Surface Antigen Status—West Virginia, 2015

Maternal HBsAg status	HepB birth dose received (%)	HepB birth dose not received (%)	Total live births in 2015 (%)
Negative	13,576 (80.4)	3,311 (19.6)	16,887 (96.7)
Unknown	308 (73.3)	112 (26.7)	420 (2.4)
Positive	26 (92.9)	2 (7.1)	28 (0.2)
Missing	N/A	N/A	123 (0.7)

HBsAg, hepatitis B surface antigen; HepB, hepatitis B vaccine.

TABLE 2

Hepatitis B Vaccine Birth Dose Receipt Frequency by Variable—West Virginia, 2015

Variable	Records per variable	Variable category	Category No. (% total)	Received birth dose (% category)
Maternal age	17,458	<35 years old	15,734 (90.1)	12,684 (80.6)
		≥35 years old	1,724 (9.9)	1,322 (76.7)
Race	17,451[d]	White	16,194 (92.8)	12,956 (80.0)
		Nonwhite	1,257 (7.2)	1,044 (83.1)
Ethnicity	17,458	Hispanic	408 (2.3)	331 (81.1)
		Non-Hispanic	17,050 (97.7)	13,675 (80.2)
Marital status	17,451[d]	Ever married	10,770 (61.7)	8,641 (80.2)
		Never married	6,681 (38.3)	5,363 (80.3)
Education level	17,370[d]	>High school	14,813 (85.3)	11,911 (80.4)
		≤High school	2,557 (14.7)	2,038 (79.7)
Health insurance	17,458	Medicaid	9,317 (53.4)	7,403 (79.5)
		Other or none	8,141 (46.6)	6,603 (81.1)
WIC supplement	17,278[d]	Received WIC	8,622 (49.9)	6,882 (79.8)
		No WIC	8,656 (50.1)	6,980 (80.6)
Gravidity	17,458	Primigravida	12,466 (71.4)	9,997 (80.2)
		Multigravida	4,992 (28.6)	4,009 (80.3)
Tobacco use in pregnancy	17,327[d]	Use	5,651 (32.6)	4,484 (79.3)
		No use	11,676 (67.4)	9,404 (80.5)
Illicit drug use in pregnancy	17,458	Use	1,175 (6.7)	914 (77.8)
		No use	16,283 (93.3)	1,3092 (80.4)
Birth attendant	17,458	Medical	16,541 (94.7)	13,412 (81.1)
		Nonmedical	917 (5.3)	594 (64.8)
Birth facility type	17,458	Hospital	17,299 (99.1)	13,977 (80.8)
		Nonhospital	159 (0.9)	29 (18.2)
Infant sex	17,458	Female	8,948 (51.3)	7,158 (80.0)
		Male	8,510 (48.7)	6,848 (80.5)
Day of week of birth	17,458	Weekday	14,445 (82.7)	11,653 (80.7)
		Weekend	3,013 (17.3)	2,353 (78.1)
Maternal HBsAg result in record[a]	17,289[e]	Records result	2,679 (15.5)	2,446 (91.3)
		Does not record	14,610 (84.5)	11,525 (78.9)
Vaccination policy[b]	17,289[e]	Has policy	7,419 (42.9)	6,425 (86.6)
		No policy	9,870 (57.1)	7,546 (76.5)
Admission orders[c]	17,289[e]	Uses orders	13,460 (77.9)	11,716 (87.0)
		Does not use	3,829 (22.1)	2,255 (58.9)

WIC, women infants and children; HBsAg, hepatitis B surface antigen.

[a]A written policy to document maternal hepatitis B surface antigen test result in the infant's medical record.

[b] A written policy to routinely administer HepB vaccine to all newborn infants before hospital discharge.

[c] Using preprinted routine admission orders to administer HepB to all newborn infants before hospital discharge.

[d] Complete data were unavailable for some records.

[e] Excludes records of infants not born in a hospital birthing facility.

TABLE 3

Crude Risk Ratios, 95% Confidence Intervals, and *P*-values (Bivariate Analyses) for Associations of Maternal, Birth, and Hospital Factors and Hepatitis B Vaccine Birth Dose Receipt—West Virginia, 2015

Variable	Bivariate comparison	CRR	95% CI	*P*-value	No.
Maternal age	<35 years (vs. ≥35 years)	1.05	1.02–1.08	<0.001	17,458
Race	White (vs. nonwhite)	0.96	0.94–0.99	0.002	17,451 [d]
Ethnicity	Non-Hispanic (vs. Hispanic)	0.99	0.94–1.04	0.65	17,458
Marital status	Ever married (vs. never married)	1.00	0.98–1.01	0.95	17,451 [d]
Education	>High school (vs. ≤High school)	1.01	0.99–1.03	0.40	17,370 [d]
Health insurance	Medicaid (vs. other or no insurance)	0.98	0.97–0.99	<0.001	17,458
WIC supplement	Received WIC (vs. did not receive WIC) during pregnancy	1.01	1.00–1.03	0.18	17,278 [d]
Gravidity	Primigravida (vs. multigravida)	1.00	0.98–1.02	0.86	17,458
Tobacco use	No tobacco use (vs. use)	1.02	1.00–1.03	0.07	17,327[d]
Illicit drug use	No illicit drug use (vs. use)	1.03	1.00–1.07	0.03	17,458
Birth attendant	Medical (vs. nonmedical) attendant	1.25	1.19–1.31	<0.001	17,458
Birth facility	Hospital (vs. nonhospital) facility	4.43	3.19–6.16	<0.001	17,458
Sex	Female (vs. male)	0.99	0.98–1.01	0.43	17,458
Day of week	Weekday (vs. weekend)	1.03	1.01–1.05	0.003	17,458
Maternal HBsAg result in record[a]	Does not record maternal test result (vs. records maternal test result)	0.86	0.85–0.88	<0.001	17,289[e]
Vaccination policy[b]	Does not have policy (vs. has policy)	0.88	0.87–0.90	<0.001	17,289[e]
Admission orders[c]	Uses preprinted admission orders for vaccination (vs. does not use orders)	1.48	1.44–1.52	<0.001	17,289[e]

CRR, crude risk ratios; CI, confidence interval; WIC, women infants and children; HBsAg, hepatitis B surface antigen.

[a] A written policy to document maternal hepatitis B surface antigen test result in the infant's medical record.

[b] A written policy to routinely administer HepB vaccine to all newborn infants before hospital discharge.

[c] Using preprinted routine admission orders to administer HepB to all newborn infants before hospital discharge.

[d] Complete data were unavailable for some records.

[e] Excludes records of infants not born in a hospital birthing facility.

TABLE 4

Adjusted Prevalence Ratios, 95% Confidence Intervals, and *P*-values Reporting Associations of Selected Maternal, Birth, and Hospital Factors with Hepatitis B Vaccine Birth Dose Receipt in Hospital Facilities—West Virginia, 2015

Variable	Mixed-effects comparison	aPR	95% CI	*P*-value
Illicit drug use	No use during pregnancy (vs. use)	1.81	1.54–2.13	<0.001
Maternal age	Age <35 (vs. ≥35)	1.34	1.17–1.54	<0.001
Race	White (vs. nonwhite)	1.02	0.86–1.21	0.80
Health insurance	Medicaid (vs. other or no insurance)	0.99	0.90–1.08	0.75
Day of week	Weekday (vs. weekend)	1.15	1.03–1.28	0.01
Maternal HBsAg result in record[a]	Does not record maternal test result (vs. records maternal test result)	0.64	0.16–2.54	0.53
Vaccination policy[b]	Does not have policy (vs. has policy)	2.20	0.58–8.38	0.25
Admission orders[c]	Uses preprinted admission orders for vaccination (vs. does not use orders)	10.60	2.12–52.72	0.004

aPR, adjusted prevalence ratios; CI, confidence interval; HBsAg, hepatitis B surface antigen.

[a] A written policy to document maternal hepatitis B surface antigen test result in the infant's medical record.

[b] A written policy to routinely administer HepB vaccine to all newborn infants before hospital discharge.

[c] Using preprinted routine admission orders to administer HepB to all newborn infants before hospital discharge.